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THE SYNTHETIC RUBBER INDUSTRY IN THE USSR DURING THE SEVEN YEAR PLAN 1959–65

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SUBJECT : Correction of CIA/RR ER 61-49

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FOR THE ASSISTANT DIRECTOR, RESEARCH AND REPORTS:

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Chief, Publications Staff

THE SYNTHETIC RUBBER INDUSTRY IN THE USSR DURING THE SEVEN YEAR PLAN 1959–65

CIA/RR ER 61-49

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THE SYNTHETIC RUBBER INDUSTRY IN THE USSR DURING THE SEVEN YEAR PLAN 1959-65

Summary and Conclusions

The USSR has established very ambitious goals for development of its lagging rubber industry during the Seven Year Plan (1959-65). Production of synthetic rubber is scheduled to increase about 170 percent, from an estimated level of about 300,000 tons in 1958, about one-fourth of that in the US, to an estimated level of almost 800,000 tons in 1965. In addition to the quantitative increase, a broader spectrum of improved types of rubber is planned, including most types of general-purpose and special-purpose rubber made in the Free World. A significant feature of the plan is the emphasis devoted to production of synthetic polyisoprene rubber, a possible substitute for natural rubber, that is scheduled to comprise about 25 percent of the total Soviet production of synthetic rubber by 1965. Other striking characteristics of the ambitious plan include the scheduled changeover to the predominant use of petrochemical raw materials in the manufacture of rubber and the adoption of more modern production processes.

At present, the USSR is the second largest producer and consumer of rubber in the world, but the Soviet rubber industry can scarcely be said to meet modern standards of efficiency or quality. Synthetic rubber is produced primarily by a high-cost process that utilizes ethyl alcohol as a raw material. In addition, the quality of Soviet rubber has been markedly inferior to the rubber produced in the US or Western Europe -- a situation that is reflected in the poor road life of Soviet tires and in the unsatisfactory performance of other rubber articles.

Confronted by the increasing requirements for rubber in a rapidly expanding economy and harassed by a domestic synthetic rubber industry that failed to keep pace with these new demands, the USSR has in recent years been a rather sizable importer of natural rubber. The major part of this rubber has been imported from Malaya, with smaller quantities coming from Indonesia, Ceylon, and Thailand and, in the form of reexports, from Communist China and the UK. Soviet imports of natural rubber rose from 35,000 tons in 1955 to an average of

about 250,000 tons in 1958 and 1959, accounting in 1958 for 3.5 percent (by value) of total Soviet imports. Imports of natural rubber decreased by about 50,000 tons in 1960, probably reflecting an improved level of stockpiles as a result of the large imports in 1958 and 1959 and possibly reflecting as well a sensitivity to the relatively high world prices for rubber that prevailed in 1960.

In addition to its imports of natural rubber, the USSR also buys synthetic rubber from East Germany and from the Free World. Soviet purchases of synthetic rubber from East Germany amounted to about 25,000 tons annually in 1955-60. Since at least 1958 the USSR also has imported small quantities of synthetic rubber from the Free World. A recent contract promulgated with Italy calls for delivery by Italy of 50,000 tons of synthetic rubber to the USSR in 1961-65, reflecting, at least in part, the lagging domestic program for production of synthetic rubber.

The total consumption of new rubber* in the USSR in 1960 is estimated to have been about 575,000 tons in contrast to an estimated level of 340,000 tons in 1955. By 1965, Soviet requirements for rubber may be approximately 900,000 to 1 million tons. By comparison, consumption of new rubber in the US in 1960 was about 1.6 million tons.

Currently, deficiencies in technology and shortages of equipment continue to impede the Soviet rubber industry, and considerable delays have been encountered in building new facilities for manufacturing rubber and bringing them successfully to projected capacity. Mastery of technology for production of major intermediates such as butadiene has been slow and painful. To alleviate this situation, the USSR has purchased equipment and process data from the Free World and apparently is interested in continuing such purchases. At present, the purchases do not appear to have been sufficient to offset the lags in domestic development, and the goal for production of synthetic rubber in 1965 probably will not be attained, particularly the plan to have polyisoprene comprise about 25 percent of the total rubber produced. The failure of this plan should result in a continuing high Soviet requirement for natural rubber through 1965, probably at least 150,000 tons annually. In spite of probable underfulfillment of plan, the high priority afforded the rubber industry should permit relatively rapid rates of growth for several years ahead, as the USSR seeks to match the West in production of consumer-oriented products that, in turn, contribute to the present lead in living standards in the West. Parallel incentives for developing the Soviet rubber industry doubtless will be the growing requirements for high-temperature, corrosion-resistant materials for industrial and military goods and the desire to reduce dependency on large imports of natural rubber.

* Excluding reclaimed rubber.

I. Status of the Soviet Rubber Industry

The USSR is the second largest producer and consumer of rubber in the world, but its production of synthetic rubber is only about one-fourth of that in the US, and the Soviet rubber industry can scarcely be said to meet modern standards of efficiency or quality. Although the USSR was a pioneer in production of synthetic rubber with a commercial facility starting up in 1932, as late as 1959 about 50 percent of the total Soviet production consisted of sodium butadiene rubber, the original type developed by the USSR and a type very inferior to types currently made in the West.*

In addition to shortcomings in the quality of Soviet rubber, production costs are high because synthetic rubber is being produced primarily by an expensive process that uses ethyl alcohol as a major raw material. Moreover, a considerable part of the alcohol utilized in production of rubber is derived from edible agricultural products, thus constituting a significant drain on the economy. In 1957, 1.7 million metric tons** of grain were consumed in producing industrial ethyl alcohol that was used chiefly for production of synthetic rubber. The high cost of producing rubber is reflected in the prices of major rubber products -- the cost of tires, for example, reportedly representing 25 to 32 percent of the cost of mass-produced Soviet trucks. 1/ ***

To supplement the domestic production of synthetic rubber, the USSR has in recent years imported substantial quantities of natural rubber to meet the growing requirements for rubber for industrial, consumer, and military applications.† In 1958 and 1959 the USSR imported natural rubber at an average of about 250,000 tons per year, 2/ well above previous levels of imports.

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* For designations and types of Soviet synthetic rubbers produced commercially or under development, see Appendix A.

** Tonnages are given in metric tons throughout this report.

*** For serially numbered source references, see Appendix C.

† In addition to the conventional use of rubber in military transport, rubber has applications in guided missiles, where resistance to corrosion or high temperature is desired, and in fuel-binders for solid propellants.

The USSR is now in the midst of a program directed toward a rapid expansion and modernization of its rubber industry during 1959-65. Investment in synthetic materials (rubber, plastics, and fibers) is scheduled to absorb 50 percent of the total investment in the chemical industry. Much larger quantities of improved copolymer (butadiene-styrene) general-purpose rubbers are to be produced, along with synthetic "natural" rubber* (polyisoprene) and special-purpose types such as butyl, nitrile, silicone, and urethane rubber. Production of some of the above types by the most efficient methods requires widespread use of refinery and natural gases as raw materials, a condition that portends the development of a large petrochemical industry in the USSR. New rubber-producing facilities are being located essentially in areas where oil or gas is available. In addition to the construction of new plants for producing rubber, the USSR is planning a sizable expansion and modernization of facilities at many existing plants.

II. Production

A. Production Facilities

In 1959, at the onset of the Seven Year Plan, seven plants producing synthetic rubber were in operation in the USSR, with at least six others planned for initial operation during 1959-65.**

B. Synthetic Rubber

Statistics in absolute terms for production of synthetic rubber are not released by the USSR, although percentage increases above previous periods occasionally have been reported. Based on a tentative estimate of production in 1955, together with Soviet reports on planned or actual percentage increases for other years, Soviet production of synthetic rubber is believed to have risen to about 350,000 tons in 1960 from a level of approximately 140,000 tons in 1950. A further increase to almost 800,000 tons is believed to be called for by 1965. In the US, production of synthetic rubber in 1960 amounted to about 1.5 million tons. The estimated production of synthetic rubber in the USSR in 1950-60 and the plan for 1965 are shown in Table 1.***

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* The so-called synthetic "natural" rubbers comprise types that have been developed rather recently with properties approximating and in some cases exceeding those of natural rubber, thus opening the possibility of more fully replacing natural rubber in some applications.

** For the locations of Soviet plants producing synthetic rubber -- in operation, under construction, or planned -- together with an indication of the types of rubber produced and changes in production planned by 1965, see Appendix B.

*** Table 1 follows on p. 5.

Table 1

Estimated Production of Synthetic Rubber in the USSR a/
1950-60 and 1965 Plan

Year	Thousand Metric Tons	Index (1950 = 100)
1950	144 b/	100
1951	172 b/	119
1952	188 b/	131
1953	212 b/	147
1954	214 b/	149
1955	240 b/	167
1956	237 c/	165
1957	273 c/	190
1958	293 d/	203
1959	323 e/	224
1960	350 f/	243
1965 Plan	790 g/	549

a. The estimates of production in absolute terms may be in error by as much as 20 percent, but the index of production is considered to be more accurate.

b. Production in 1950-55 was computed as follows. An estimate was made for production of synthetic rubber in 1955 based on a Soviet report during 1956 that half of the ethyl alcohol produced in the USSR was used in production of synthetic rubbers. 3/ Half of the total output of ethyl alcohol produced in 1955 would amount to 504,000 tons. 4/ Another report indicates that 2.2 tons of ethyl alcohol are used in the USSR to produce 1 ton of rubber, 5/ resulting in an estimate of 229,000 tons of rubber derived from alcohol. A small amount of chloroprene rubber (not derived from alcohol) also was produced in 1955, making the estimate for the total production of rubber about 240,000 tons. Estimates for 1950-54 were then based on percentage increases reported in Soviet newspapers, 6/ working back from the estimate for 1955.

c. Production in 1956 was based on the report that production in 1957 was planned to be 15 percent more than that in 1956, the estimate for 1957 having first been derived from a Soviet index showing that production in 1957 was 45 percent greater than that in 1952. 7/

Table 1

Estimated Production of Synthetic Rubber in the USSR
1950-60 and 1965 Plan
(Continued)

d. A Soviet journal published late in 1958 stated that the Soviet synthetic rubber industry was producing 22 percent more than in 1955. 8/
e. A Soviet index of production for rubber shows production in 1959 to have been 72 percent greater than in 1952. 9/
f. No Soviet reports are available on the increment in production of synthetic rubber in 1960, but the increase is believed to have been modest, not exceeding 10 percent, because three of the four plants planned for initial operation in 1960 failed to open as scheduled.
g. Based on a statement in a Soviet journal that production of synthetic rubber in 1965 was scheduled to be 2.7 times that in 1958. 10/ Somewhat conflicting reports on the planned increase in capacity for rubber (as opposed to production) have been published by the USSR, one report stating that the capacity for synthetic rubber in 1965 would be 3.4 times that in 1957 and another that the capacity in 1965 would be 3.7 times that in 1958. Thus the scheduled increase in production also may be subject to change.

The rapid increase in production of synthetic rubber planned during 1959-65 is to be accompanied by significant changes in the composition of the total output. Perhaps the most striking feature of the developmental program is the plan to bring capacity for production of polyisoprene to 25 percent of the total capacity for synthetic rubber. Polyisoprene is one of the new synthetic "natural" rubbers, and implementation of this plan potentially could have a marked effect on Soviet imports of natural rubber in 1965.* A number of other changes in the composition of output are planned. Capacity for production of the inferior sodium butadiene rubber is scheduled to fall from about 50.7 percent of the total capacity for synthetic rubber in 1959 to about 8.5 percent** in 1965. 12/ Capacity for production of copolymer

* For a discussion of the difficulties encountered by the USSR in developing commercial production of polyisoprene, see VI, B, p. 14, below.
** One Soviet source predicts a decline to 9.5 percent of the total capacity in 1965. 11/

(butadiene-styrene) rubber is to rise from 33 percent of the total output in 1959 to 60 percent in 1963, then fall somewhat as a percentage of the total output by 1965, 13/ presumably as a result of the rising production of polyisoprene. Improved processes are to be used in production of copolymer rubber, with the so-called "cold"* oil-extended rubber scheduled to comprise 94 percent of the total copolymer rubber by 1963 as opposed to only 57 percent in 1960. 14/ Of the oil-resistant rubbers, capacity for Soviet chloroprene rubber (US neoprene) is scheduled to increase about fivefold by the end of the Seven Year Plan compared with capacity in 1959. 15/ Capacity for butyl rubber is variously reported to face a 28-fold or 40-fold increase by 1965, 16/ reflecting the low production base in 1958, when production probably was little more than 1,000 tons. The planned changes in the composition of Soviet capacity for synthetic rubber between 1 January 1959 and 1 January 1965 are shown in Table 2. 17/

Table 2

Distribution of Synthetic Rubber Produced in the USSR, by Type a/
1 January 1959 and 1 January 1965

Percent

Type of Rubber	1 January 1959	1 January 1965
Copolymer and latices (SKS)	38.3	43.6
Polyisoprene (SKI)	Negl.	25.0
Chloroprene (Nairit)	6.4	11.7
Sodium butadiene (SKB)	50.7	8.5
Butyl	0.4	5.3
Nitrile (SKN)	3.8	2.9
Polyisobutylene	0.4	1.3
Other special-purpose	Negl.	1.7
	100.0	100.0

a. This table refers to changes in capacity for rubber rather than actual production, and the time periods vary slightly from those of the Seven Year Plan (1959-65), but the figures are considered to be a reliable guide to trends in production during the period. For example, the official Seven Year Plan calls for polyisoprene to comprise 23.8 percent of the total production of rubber in 1965.

* The term cold as applied to rubber refers to a superior copolymer rubber that is polymerized at lower temperatures than the earlier types that were developed.

C. Reclaimed Rubber

The USSR produced 76,000 tons of reclaimed rubber in 1956 and 91,000 tons in 1958, 18/ production in 1958 being about one-third of that in the US. Reportedly the supply of reclaimed rubber is inadequate, and production in 1965 is scheduled approximately to double the quantity produced in 1958. 19/ Plants producing reclaimed rubber, which are scheduled for expansion or modernization in 1959-65, include those at Orenburg, Chekhovo, and Kiev.

III. Trade in Natural and Synthetic Rubber

A. Imports of Natural Rubber

Imports of natural rubber contribute substantially to the total supply of rubber in the USSR and at the same time represent a significant element in Soviet foreign trade, especially with underdeveloped countries. Imports of natural rubber rose from 35,000 tons in 1955 to an average of about 250,000 tons in 1958* and 1959. In 1959, imports comprised almost one-half of the total supply of rubber,** accounting for about 3.3 percent of the total Soviet imports and 26 percent of Soviet imports from underdeveloped countries. 20/ Imports of natural rubber by the USSR in 1950 and 1955-60 are shown in Table 3.*** The sharp rise in imports in 1958 and 1959 apparently was caused by the failure of the Soviet synthetic rubber industry to keep pace with the mounting requirements for rubber by the industries producing tires and other rubber articles. The large amounts of rubber imported in 1958 and 1959 are believed to have resulted in addition in a surplus of the total available rubber above consumption, permitting the accretion to stockpiles in the 2 years to total an estimated quantity of 70,000 to 100,000 tons.† Thus, in 1960, when Soviet imports of natural rubber dropped by about 50,000 tons, the replenished stockpiles of rubber were drawn on to help fill the gap. An additional factor in the Soviet decision to cut back on imports of rubber in 1960 may have been the high world prices of natural rubber that prevailed for most of the year. In the first 8 months of 1961, Soviet imports of natural rubber were well above the level of imports in the first 8 months of 1960, possibly in response to the lower world price for rubber.

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* In 1958, imports of natural rubber accounted for 3.5 percent (by value) of the total Soviet imports.

** For further discussion, see IV, p. 10, below.

*** Table 3 follows on p. 9.

† This figure is based on the estimated requirements by the Soviet tire industry in 1958 and 1959 and on a Soviet statement indicating that tires probably account for about 60 percent of the total rubber consumed. See Table 4, p. 11, below.

Table 3

Imports of Natural Rubber by the USSR a/
1950 and 1955-60

	Thousand Metric Tons
1950	85
1955	35
1956	141
1957	146
1958	259
1959	242
1960	191

a. 21/

Malaya has been the principal source of natural rubber for the USSR, accounting for perhaps 70 to 75 percent* of the total imports of rubber by the USSR in 1955-60. The USSR also imports natural rubber produced in Indonesia, Ceylon, and Thailand. A part of the rubber supplied to the USSR in the form of reexports is from Communist China and the UK. Soviet purchases of natural rubber from the UK amounted to almost 50,000 tons in 1960, doubling the level of 1959. 23/

The USSR apparently plans to curtail its large purchases of natural rubber as soon as domestic production of synthetic rubber can be expanded sufficiently to meet a larger share of its requirements. In 1959 a Soviet journal declared that the large imports of natural rubber were "a temporary market-based phenomenon" and that the planned expansion of the synthetic rubber industry would permit a sharp reduction in the use of natural rubber, leading to a considerable reduction of the "unjustifiably" large imports. 24/ Viktor Fedorov, Chairman of the State Committee for Chemistry, declared early in 1959 that the USSR would cease to need imports of natural rubber in the course of the Seven Year Plan. 25/ The statement is believed to have been based on hopes that by 1965 the USSR would achieve production of polyisoprene rubber on a very large scale. Fedorov's statement, however, appears to be contrary

* Derived from Soviet trade statistics. 22/ The figure should be considered an approximation because Soviet trade statistics do not show the true country of origin for natural rubber imported from Communist China.

to a Soviet plan calling for natural rubber to comprise 24 percent of the total rubber used in the tire industry in 1965. 26/

B. Imports of Synthetic Rubber

The USSR imported about 25,000 tons of synthetic rubber annually from East Germany during 1955-60. Small quantities of synthetic rubber have been imported from Canada since 1958, and 8,000 tons were imported from Italy in 1959. Apparently, Soviet interest in importing synthetic rubber from the Free World has been increasing, presumably to cover the domestic lag in construction of new facilities for producing rubber. A recent contract concluded between Italy and the USSR calls for delivery by Italy of 50,000 tons of synthetic rubber to the USSR during 1961-65. 27/ In addition, shipments of synthetic rubber from the US to the USSR were licensed during 1961, and the USSR signed a contract with Japan whereby Japan will export 2,000 tons of synthetic rubber to the USSR in August and September 1961. 28/

C. Exports of Rubber

Small quantities of both natural and synthetic rubber are exported by the USSR, principally to the European Satellites. Soviet exports of rubber rose moderately from about 34,000 tons in 1955 to 49,000 tons in 1960, with Czechoslovakia and East Germany receiving about half of the total exports. 29/

IV. Supply and Consumption of Rubber, 1955-60

Consumption of synthetic and natural rubber in the USSR during 1955-60 rose from an estimated total of 340,000 tons in 1955 to about 575,000 tons in 1960.* In 1955-57 and in 1960 the USSR may have drawn on domestic stockpiles of rubber to meet part of its requirements. The substantial imports of rubber in 1958 and 1959, however, are believed to have resulted in an excess of supply above consumption for those years and permitted an accretion to stockpiles, possibly on the order of 70,000 to 100,000 tons for the 2-year period. The estimated availability and consumption of new rubber in the USSR during 1955-60 are shown in Table 4.**

* By comparison, consumption of new rubber in the US in 1960 was 1.6 million tons. 30/

** Table 4 follows on p. 11.

[redacted]

Table 4

Estimated Availability and Consumption of New Rubber in the USSR a/
1955-60

Thousand Metric Tons

Year	Production of Synthetic Rubber	Imports b/	Exports b/	Availability	Consumption c/	Possible Changes in Stockpiles d/
1955	240	61	34	267	340	-73
1956	237	167	46	358	378	-20
1957	273	170	47	396	426	-30
1958	293	285	42	536	480	+56
1959	323	275	52	546	516	+30
1960	350	228	49	529	573	-44

a. Excluding reclaimed rubber.
b. Including both natural and synthetic rubber.
c. Estimates of consumption are based both on an assumption that on the average 20 kilograms of rubber are used in a Soviet tire and on a Soviet report indicating that consumption of rubber for tires probably accounts for about 60 percent of the total consumption of rubber. 31/ A Chinese source, apparently using Soviet factors, also suggests that 20 kilograms of rubber are used per tire, although the USSR is not specifically mentioned. 32/ Production of tires in the USSR in 1955-60 was as follows (in thousand units):

1955:	10,190	1957:	12,786	1959:	15,481
1956:	11,334	1958:	14,395	1960:	17,200

d. The estimates of changes in stockpiles are potentially subject to a large margin of error, for both production and consumption of rubber in the USSR must be estimated.

[redacted]

The USSR apparently failed to meet the total requirements for rubber articles during 1955-60 in spite of the accretions to rubber stockpiles during part of this period. Reports in the Soviet press reveal that many agricultural and industrial vehicles have been idle because of a lack of tires and that criticism continues concerning the limited road life of tires and the poor quality of other rubber articles such as belting.*

V. Raw Material Base

A dramatic shift in the raw material base of the Soviet synthetic rubber industry is planned during 1959-65. Butadiene, a vital intermediate for production of general-purpose rubber, is scheduled to be produced largely from natural and refinery gases rather than by using expensive ethyl alcohol. In addition, acetylene, a product used in producing oil-resistant types of rubber, is planned for production largely from hydrocarbon gases rather than from calcium carbide, which requires large inputs of electric power. The planned changes in the raw material base of the rubber industry by 1965 are shown in Table 5.

Table 5

Planned Development of the Raw Material Base
of the Synthetic Rubber Industry in the USSR a/
1958, 1959, and 1965

	Percent of Capacity		
	1958	1959	1965
Ethyl alcohol	92	86	20
N-butane	0	6	35
Isobutane	0	0	10
Isopentane	0	0	20
Acetylene from calcium carbide	7	6	4
Acetylene from hydrocarbon gases	0	0	8
Other	1	2	3
Total	100	100	100

a. 33/

* In some cases the poor quality of Soviet rubber goods is caused not only by inferior rubber but also by the inadequate quality of other component materials, such as carbon black or textile cord.

VI. Problems Encountered by the USSR in Expanding the Synthetic Rubber Industry

The USSR has been traditionally slow in building facilities for production of synthetic rubber, and construction periods of 5 to 8 years have not been unusual. Progress remained unsatisfactory even following the announcement early in 1958 of the decision to accelerate the development of the chemical industry. In 1959, lags occurred in the construction of new plants at Stavropol', Sterlitamak, and Karaganda and in the expansion of existing facilities at Krasnoyarsk and Sumgait. Similarly, in 1960, three of the four plants scheduled to begin production -- those at Omsk, Karaganda, and Stavropol' -- failed to do so, although all had been listed as "particularly important" construction projects. The one plant going into operation on schedule, that at Sterlitamak, imported its major raw material, butadiene,* because its own facilities for producing butadiene were not in operation in 1960. For the second consecutive year, plans to commission the rubber plant at Karaganda failed to materialize. 34/ At Omsk, after 8 years of construction, the rubber plant was still not ready for operation, and some of the original designs had become outmoded. 35/ Facilities for production of butyl rubber, planned to be in operation at Sumgait as early as 1957, still had not been completed by the end of 1960.

The lengthy delays experienced by the USSR in building new plants and bringing them into successful operation are symptomatic of a number of serious problems confronting the Soviet chemical industry in its efforts to implement the ambitious 7-year goals for producing rubber. The most pressing of these problems concerns the adequacy of present Soviet technology and capacity for production of chemical equipment. Other factors that will affect fulfillment of the plan include the pace of development of industries producing the necessary raw and other materials and the availability of skilled personnel, both for adapting new processes to commercial plants and for manning the completed plants. Some of these major problems are discussed briefly below.

A. Equipment

The Soviet rubber industry continues to be handicapped by shortages of equipment, and the effects of these shortages are intensified by faulty installation and by defects in certain equipment, the latter probably caused by the forced tempo of operation of the chemical machine building industry and its relative inexperience with many of the newer varieties of equipment required by the chemical industry. Alarmed at the general shortages of chemical equipment, Soviet authorities at the

* The butadiene probably was procured from another plant in the USSR, for there is no evidence of such imports from abroad.

June 1959 Plenum of the Communist Party approved measures to expedite construction of new chemical machine building plants and to divert to the chemical industry a larger share of production from existing machine building plants. The situation has remained unsatisfactory in spite of these measures. In 1960 the plan for supplying equipment on a scheduled priority to 33 chemical projects in the RSFSR (including a number of facilities for producing rubber) was fulfilled by only 82.5 percent. An early end to the difficulties in procuring equipment is not yet in sight, particularly as more than one-third of the new Soviet chemical machine building facilities failed to begin their scheduled operation in 1960. 36/

Recognizing that the difficulties already experienced with chemical equipment may persist and seriously affect the fulfillment of the long-range plan for chemicals, the USSR is making strenuous efforts to purchase equipment for production of a number of chemical products, including rubber. One Western firm has contracted to supply the USSR with equipment for processing butyl rubber, and negotiations were underway in 1961 with another Western firm to supply equipment for producing styrene-butadiene copolymer rubber. 37/ Other contracts have been signed for the sale of technical data and equipment to the USSR for the rubber products industry, and one large automated facility for production of tires, purchased in this manner, has already gone into operation. Some equipment for the Soviet rubber industry also is being imported from the Satellite countries -- both Czechoslovakia and East Germany, for example, having supplied equipment for the Soviet rubber plants at Stavropol' and Sumgait.

B. Lagging Technology

The USSR has found the development and perfection of advanced processes for production of rubber or its intermediates to be a very decided bottleneck in the projected expansion of the synthetic rubber industry. Difficulties are apparent particularly in the engineering and design work required to transform a laboratory or pilot-plant operation to one permitting production on a commercial scale. Technical lags in the development of certain types of rubber or its intermediates have included the following problems.

1. Polyisoprene

Early commercial development of polyisoprene rubber, one of the so-called synthetic "natural" types, is of paramount importance if the USSR is to achieve its plan to have this rubber constitute 25 percent of the total capacity for production of rubber by 1965. Experimental production of polyisoprene (SKI) was achieved as early as 1954 at a rubber plant in Yefremov and subsequently at a plant in

Voronezh, but apparently either the product or the process was not satisfactory. In 1959 the subject of the development of a suitable process for producing polyisoprene occasioned a sharp exchange of views between the President of the Academy of Sciences and the Chairman of the State Committee for Chemistry. 38/ The USSR announced in March 1960 that an improved polyisoprene rubber (SKI-3) had been developed, 39/ but an article in the Soviet press in August 1960 admitted that the problem of producing isoprene rubber had not yet been solved. 40/

In August 1961, however, development of a new, continuous, highly automated process for production of polyisoprene rubber was reported at an institute in Leningrad, with the new process allegedly permitting production at one-fifth the cost of other processes currently available. 41/ The magnitude of the reduction in cost suggests, by inference, that previously developed processes for polyisoprene in the USSR may have been quite inefficient and may have contributed to the delay in attaining production on a commercial scale. In the West a number of new processes that have been developed recently show promise of very economical production of polyisoprene, and it is not yet clear how production costs of the new Soviet process will compare with these.

2. Butadiene

Another major technological hurdle facing the USSR is production from natural and refinery gases of butadiene, a key intermediate in the manufacture of general-purpose synthetic rubber. As late as 1959 the USSR produced 86 percent of its synthetic rubber from butadiene obtained by processing ethyl alcohol. The basic process adopted by the USSR for producing butadiene in 1959-65 is a two-step operation, proceeding from butane to butadiene via butylene. The first shop to use the new process was completed at Sumgait in October 1959, at least a year later than scheduled, but the actual output is not believed to have been attained until some time in 1960. Subsequently, there has been criticism of the quality of the rubber manufactured by the Sumgait plant. Difficulties at this plant may have accelerated Soviet efforts to develop a one-stage route to butadiene, perhaps similar to a one-stage process in use in the US. In 1961 the USSR announced that scientists at Sumgait had discovered a method of producing synthetic rubber from natural gas by a single-stage process, 42/ but no indication was given of the time that would be required to achieve commercial production.

3. Oil-Extended Rubber

Certain oils can be added to types of copolymer (butadiene-styrene) rubber to extend the amount of rubber produced. In addition, these oil-extended rubbers have a lower buildup of heat than conventional types of rubber and thus have a favorable effect on the life of tires.

The rubber produced in the largest amounts in the USSR, a sodium polymerized butadiene (SKB), apparently is not suitable for oil-extension, and Soviet efforts in recent years have been directed to the application of oil-extension to butadiene-styrene copolymer rubber (SKS). Experimental production of oil-extended rubber began in 1955-56 at the Voronezh Synthetic Rubber Plant, but a report in 1958 indicated that the rubber proved to be unsatisfactory and that commercial production was thereby delayed for several years. 43/ One of the reasons for the failure was the selection of an oil that lacked optimum properties for such use. Other difficulties also were apparent, and as late as October 1960 an excessive amount of substandard oil-extended rubber was being produced by a shop at Sumgait, allegedly because of inefficient performance in mixing the batches of materials. 44/ A rather interesting, if amusing, attitude toward quality control is discernible in the statement attributed to employees of the quality control department at the Sumgait plant -- "We cannot consider rubber as substandard solely because it is sticky. It simply does not display the necessary thermoplasticity and hardness." 45/ Nevertheless, in the light of a report that the new plant at Sterlitamak produces an improved oil-extended rubber, 46/ Soviet scientists may have made some progress recently in developing such a product.

C. Labor

A shortage of both technical and skilled labor in the Soviet rubber industry may cause problems during the Seven Year Plan. The persistent complaints of the lack of technical designs may well indicate a shortage of qualified engineering personnel at the planning institutes. In addition, some of the complaints concerning the quality of rubber produced appear to reflect a lack of experience on the part of the workers. The turnover of labor at at least one of the new Soviet rubber plants is excessive, with a novice reportedly arriving to replace one of every four workers in 1960. 47/

VII. Prospects

Although this report has stressed some of the present failings of the Soviet synthetic rubber industry, the continued high priority afforded this industry should permit a relatively rapid rate of growth for the next several years. In spite of this progress, however, the present shortcomings in equipment and technology probably will result in an underfulfillment of the Seven Year Plan.

In spite of the reported development of an improved process for polyisoprene rubber, it is unlikely that the goal calling for this product to comprise 25 percent of the total capacity for synthetic rubber in 1965 will be attained. Inasmuch as the total Soviet

requirements for rubber should roughly double by 1965* (suggesting a level of consumption of about 900,000 to 1 million tons), the failure to attain the goal for production of polyisoprene should result in a continuing high Soviet requirement for natural rubber through 1965, probably at least 150,000 tons annually. Thus it appears unlikely that development of the Soviet synthetic rubber industry will have a marked effect on the structure of Soviet trade with the underdeveloped rubber-producing nations by 1965, although natural rubber may well comprise a smaller share of the total rubber consumed in the USSR in 1965. More difficult is an assessment of developments after 1965, but it appears likely that the USSR will become increasingly independent of purchases of natural rubber, with political considerations largely determining the level of imports.

In the immediate period ahead, the USSR may be expected to continue its efforts to purchase technology and equipment for rubber from the Free World. Primary areas of interest probably will be the newer synthetic rubbers such as polyisoprene and advanced processes for production of intermediates such as butadiene and acetylene. In addition, purchases will be attempted for some of the lesser intermediates, such as emulsifiers, or the technology required to produce them.

* Production of tires is scheduled to double in 1965 compared with 1958, and production of some other major rubber articles is scheduled for an even faster rate of growth.

APPENDIX A

TYPES OF SYNTHETIC RUBBER IN THE USSR*

Designation	Composition	Comment
Butadiene Rubbers**		
Rodless***		
SKB 20 SKB 25 SKB 30 SKB 35 SKB 40 SKB P40 SKB 45b SKB P45 SKB 50b SKB P50 SKB 55b		General-purpose rubber used for tires, conveyor belting, and other rubber articles
Rod***		
SKB 45S SKB 50S SKB 55S SKB 60 SKB 66 SKB 7P-50S SKB 7P-55S SKB 7P-60S SKB 50SR		General-purpose rubber with applications as above
SKBM†	Polybutadiene, lithium catalyzed	For use at low temperatures
SKV††	Polybutadiene, potassium catalyzed	
Butadiene-Styrene Rubbers		
SKS 10	10% styrene	For use at low temperatures
SKS 30	30% styrene	
SKS 30A	30% styrene	Cold polymerized
SKS 30AM	30% styrene, 14 to 22% oil	Cold polymerized, oil-extended
SKS 30ARM15	30% styrene, 15% oil	Cold polymerized, oil-extended
SKS 40D	40% styrene	Used for shoe soles
SKS 50	50% styrene	Used for caustic and acid-resistant hoses
SKS 90	90% styrene	Used for shoe soles
Butadiene-Styrene Rubber Latices		
SKS 30P	30% styrene	Sealant in food industry
SKS 30U	30% styrene	For adhesives
SKS 30K	30% styrene	
SKS 30Sh	30% styrene	For tire cord, leather substitutes
SKS 30ShR	30% styrene	For tire cord, leather substitutes
SKS 50I	50% styrene	For wire and cable
SKS 50GP	50% styrene	For adhesives

* Including rubbers under development and possibly produced on a small scale in the USSR as well as those in full-scale commercial production. The information was developed from a number of Soviet and Free World publications.

** The two-digit numbers following SKB and SKV designations refer to the maximum plasticity of the given type.

*** The terms rodless and rod are Soviet designations that apparently refer to types of rubber prepared by different methods of polymerization. In the rod type the sodium polymerization catalyst is carried on steel rods.

† With designations ranging from 35 to 55 depending on the plasticity.

†† With designations ranging from 25 to 55 depending on the plasticity.

Designation	Composition	Comment
	Butadiene-Methyl Styrene Rubbers	
SKMS 10	10% styrene	For use at low temperatures
SKMS 30	30% styrene	
SKMS 30A	30% styrene	Cold polymerized
SKMS 30AM	30% styrene	Cold polymerized, oil-extended
SKMS 50	50% styrene	For use in storage tanks and caustic and acid-resisting hoses
	Butadiene-Acrylonitrile Rubbers	
SKN 18	18% acrylonitrile	Typical uses of this class include oil-resistant applications as seals or packing.
SKN 26	26% acrylonitrile	
SKN 40P	40% acrylonitrile	
SKN 40T	40% acrylonitrile	
	Butadiene-Methyl Vinyl Pyridine Rubbers	
SKMVP 10	10% vinyl pyridine	Hot polymerized (50° C), with very high abrasion resistance
SKMVP 15	15% vinyl pyridine	
SKMVP 25	25% vinyl pyridine	
SKMVP 40	40% vinyl pyridine	
SKMVP 10A	10% vinyl pyridine	Cold polymerized (5° C), with very high abrasion resistance
SKMVP 15A	15% vinyl pyridine	
SKMVP 25A	25% vinyl pyridine	
SKMVP 40A	40% vinyl pyridine	
	Chloroprene Rubbers and Latices	
Nairit		
Nairit A		Used for cable
Nairit B		
Nairit K		
Nairit N		Used for cable
Nairit NT		Used for adhesives
Nairit L-2		A rubber latex
Nairit L-3		A rubber latex
Nairit L-4		A rubber latex
Nairit L-7		A rubber latex
Nairit S	3 to 5% styrene	A chloroprene-styrene rubber
	Butyl Rubber	
Butilkauchuk A		Molecular weight not less than 40,000
Butilkauchuk B		Molecular weight not less than 35,000
Butilkauchuk V		Molecular weight not less than 30,000
	Piperylene Rubber and Latices	
SKP	Poly, 3-pentadiene	
DBP 25		Butadiene-piperylene latex
DBP 50		Butadiene-piperylene latex, used in asbestos articles
DBP 60		Butadiene-piperylene latex, used in the asbestos industry
	Butadiene-Vinylidene Chloride Latex	
DVKHB 70		Used in production of leather substitutes

Designation	Composition	Comment
	Dimethyl Siloxane Rubber	
SKT	Silicone rubber	With applications at high temperatures and in electrical work
	Fluorine Rubbers	
SKF 32		Typical properties of fluorine rubbers include resistance to corrosive liquids and to high and low temperatures.
	Silicone-Fluorine Rubbers	
FKS		Used for heat-resistant seals
	Isoprene and Polybutadiene Rubbers	
SKI	Polyisoprene	Used for tires
SKI 3	Polyisoprene	
SKD	Polybutadiene	Uses Ziegler catalyst and has high resistance to wear
SKLD	Polybutadiene	Uses lithium catalyst
	Ethylene-Propylene Rubber	
SKEP		Potential substitute for natural rubber
	Carboxylate Rubber	
SK 1-30		Of potential value in truck tires
	Polyisobutylene	
P 85 P 118 P 155 P 200		Typical applications include anticorrosion coatings, acid-resistant hoses, and insulation of cable.
	Polysulfide	
Tiokol "Da" Tiokol "Da" RVDM		Used to prepare sealants

APPENDIX B

PLANTS FOR PRODUCING SYNTHETIC RUBBER IN THE USSR: IN OPERATION, UNDER CONSTRUCTION, OR PLANNED

Location	Products	Remarks
Irkutsk area*		Under construction. Production probably will include chloroprene rubber.
Kazan'	SKB (sodium polymerized butadiene rubber)	
Krasnoyarsk	SKB	Production of oil-extended rubber is planned by the end of 1961. Capacity of the plant is scheduled to be nearly doubled, possibly by 1965.
Omsk		Under construction, with initial operation scheduled in 1960, but not in operation as of mid-1961.
Stavropol'**	Copolymer rubber based on butane	Initial production of latex was reported in May 1961 and of rubber in June 1961.
Sterlitamak	Copolymer rubber based on butane	Under construction. The initial production of rubber, based on imported butadiene, was reported in April 1960. The first butadiene was produced at this plant in January 1961 but meets only part of the plant's requirements.
Sumgait	Oil-extended copolymer rubber based on synthetic alcohol, nitrile rubber, and copolymer rubber based on butane	Production is scheduled to increase about 200 percent in 1959-65. Future production is to include butyl rubber and polyisobutylene.
Temir Tau***		Originally scheduled for operation in 1959. The first butadiene was produced in June 1961, but rubber shops were not yet in operation. Future production may include chloroprene rubber.†
Volzhskiy		Planned for construction as a multipurpose chemical combine.
Voronezh	SKB, styrene-butadiene copolymer, oil-extended copolymer, latex, experimental production of polyisoprene rubber	
Yaroslavl'	SKB, nitrile rubber, butyl rubber, oil-extended frost-resistant rubber	Production of synthetic rubber is planned to double during 1959-65.
Yefremov	SKB, polyisobutylene, butyl rubber, experimental production of polyisoprene rubber	Production of bromobutyl rubber is planned.
Yerevan	Chloroprene rubber and latex	Production is scheduled to double in 1959-65. The plant is scheduled to convert from calcium carbide to natural gas as raw material for production of the required acetylene.

* Presumably located in Irkutsk Oblast, possibly north of the city of Irkutsk in the Angarsk-Usol'ye area.
** Referred to either as the Stavropol' Synthetic Rubber Plant or as the Kuybyshev Synthetic Rubber Plant.
*** This plant also is referred to as the Karaganda Synthetic Rubber Plant.
† An oil-resistant rubber produced from acetylene and hydrochloric acid.

APPENDIX C

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